

THE
Malayan Agricultural Journal.

Vol. XIV.]

MAY, 1926.

[No. 5.

OBITUARY.

With deep regret we have to record the death of Inche' Mohamed Zain bin Mohamed Haniff, Junior Agricultural Assistant, Butterworth, which occurred in Penang on April 27th, 1926.

MALAYAN GUANO DEPOSITS.

V. R. GREENSTREET.

Phosphatic deposits occur in caves in limestone hills in various parts of Malaya, extending also through Siam and into the Shan States. The manurial value of these deposits has long been recognised by the cultivators of *padi*, particularly in Kedah and Perlis where there is close proximity between cave and *bendang*. Although the origin of the phosphatic element has been attributed to the original limestone rock(1) analyses of samples of limestone have failed to reveal its presence. There is little doubt therefore but that the deposits have a common origin in the excrement and dead bodies of bats. In those caves which still contain vast numbers of bats there is a constant rain of excrement which, when quite fresh and sticky is remarkable for its high nitrate content,(2) a fact which was exploited as far back as 1876 when fresh bat-guano was used for the manufacture of saltpetre. The nitrate content very rapidly diminishes and combination of the excrement with limestone usually produces a substance possessing only a low nitrogen content. The variety of forms which this phosphatic material presents is very great, varying from entirely amorphous to nearly completely crystalline, from a texture almost homogeneous to forms with over 50 per cent pore space and in colour from black through brown, red and yellow to nearly white. As with the exception of that of the author(3) there appear to be only two published analyses(4) of Malayan phosphates this article has been written in order to place on record the results of analyses carried out during the last five years. The analyses of Batu Caves guano, samples number 1, 2 and 3, of Batu Kurau guano and Kampong Reman guano were carried out by Mr. C. D. V. Georgi, the remainder by the author assisted by Inche Abdul Majid. It has been found convenient to group the deposits according to the State in which they occur.

SELANGOR.

The principal Selangor deposits occur in the Batu Caves while there is an insignificant deposit in a granite cave at the Gap. The composition, which is given in table 1, shows that, although Batu Caves guano is in no instance of high quality, the phosphoric acid and nitric acid content decrease rapidly with the depth of the strata.

(1) E. G. Willbourn. Journal Straits Branch, Royal Asiatic Society 1922.86.237

(2) W. F. Maxwell. Journal Straits Branch, Royal Asiatic Society 1892.103.
W. B. D'almeida. Journal Royal Geographical Society, 1876.

(3) The Composition of Kedah and Perlis phosphates. Malayan Agricultural Journal 1923.11.70.

(4) L. Wray. Perak Museum Notes I.1892.72.
A. Voelker. Bat Guano. 1878.

TABLE 1.

Percentage composition of guano from Batu Caves and the Gap.

Description of Sample.	Batu Caves 1	Batu Caves 2	Batu Caves 3	Batu Caves 4	Gap.
	Surface sample 1922.	Sample from depth of 2ft. 1922.	Sample from depth of 4ft 1922.	Bulked sample 1925	
Moisture -	6.0	0.8	2.7	24.6	3.4
Loss on ignition -	11.4	5.7	19.0	23.2	18.4
Nitrogen (Nitric) -	0.55	nil.	nil.	...	...
Nitrogen (Ammoniacal and organic) -	0.42	0.21	0.38	...	1.1
Nitrogen (Total) -	0.97	0.21	0.38	0.72	...
Phosphoric Acid ($P_2 O_5$) -	11.25	2.50	3.56	10.20	2.05
Equivalent to tri- calcium phosphate ($Ca_3 P_2 O_8$) -	24.6	5.5	7.8	22.2	4.5

PERAK.

There are numerous limestone hills containing caves in the neighbourhood of Ipoh but only one sample of guano, from Gunong Tunggai, has been received for analysis; the depth to which the sample was taken is unknown. A deposit of insignificant value occurs at Batu Kurau in the Larut district. The composition of these samples is shown in table 2.

TABLE 2.

Percentage composition of guano from Gunong Tunggai and Batu Kurau.

Description of Sample.	Gunong Tunggai Kinta.	Batu Kurau Larut.
Moisture -	8.5	21.3
Loss on ignition -	20.7	26.7
Nitrogen (Total) -	0.5	1.5
Phosphoric Acid ($P_2 O_5$) -	5.7	0.5
Equivalent to tricalcium phosphate ($Ca_3 P_2 O_8$) -	12.4	1.2

A limestone cave at Gunong Pondok, Padang Rengas contains probably the richest guano in the country. The limestone rock which at the entrance to the cave consists largely of crystalline calcite becomes more and more amorphous as it comes into contact with the bat-excrement in the interior until it finally loses its crystalline character entirely. In some strata the rock is changed to a soft, pale-yellow powder while in others it is semi-crystalline and cellular. The floor of the mouth of the cave consists to a considerable depth of earthy, chocolate-coloured matter. The cave, which is approximately twenty-five feet wide by six hundred feet deep, contains vast numbers of bats and in consequence there is a continuous deposition of excrement. Twenty-four samples of guano from various depths throughout the cave have been analysed and the results are shown in table 3.

TABLE 3.

Percentage composition of guano from Guanig Pondok.

Description of Sample.	Sample number.												
	1	2	3	4	5	6	7	8	9	10	11	12	
Moisture	-	18.9	15.8	13.5	9.4	19.7	16.0	15.6	10.3	16.1	21.7	19.2	18.5
Loss on ignition	-	55.8	46.3	21.7	35.2	13.8	29.1	25.8	41.7	5.8	22.0	8.7	14.8
Nitrogen (Nitric)	-	1.9	2.1	1.8	nil.	nil.	7.0	nil.	1.1	nil.	nil.	nil.	1.6
Phosphoric acid (P ₂ O ₅)	-	5.5	12.0	24.0	19.0	23.0	18.0	24.0	15.0	31.0	15.0	30.0	14.5
Equivalent to tricalcium phosphate (Ca ₃ P ₂ O ₈)	-	12.0	26.2	52.4	41.5	50.2	39.3	52.4	32.8	67.7	32.8	65.5	31.6

TABLE 3.
Percentage composition of guano from Gunung Pondok.—Contd.

Description of Sample.	Sample number.												
	Soft rock.	Hard rock.	Hard rock.	Hard rock.	Hard rock.	Rock crystals.	Brown Powder.	Grey Powder.	Brown Powder.	Fresh and sticky.	Very fresh and sticky.	Black Powder.	Metamorphic limestone.
Moisture	13	14	15	16	17	18	19	20	21	22	23	24	
-	8.1	nil.	nil.	nil.	nil.	9.2	8.0	15.0	24.6	42.2	10.9	11.7	
-	8.1	39.5	16.5	21.5	34.9	18.2	8.1	10.4	(a)	(a)	15.3	5.1	
-	nil.	nil.	nil.	nil.	nil.	nil.	nil.	nil.	3.1	4.0	nil.	nil.	
-	36.0	3.5	28.0	2.4	17.0	20.0	34.3	19.2	10.0	19.0	33.0	30.4	
-	78.5	7.6	61.1	5.2	37.1	43.6	75.0	41.9	21.8	41.5	72.0	66.4	

(a) Loss on ignition unable to be determined owing to presence of nitric acid causing deflagration.

These figures show, that Gunong Pondok guano contains an average of 20 per cent phosphoric acid, that fresh samples contain an average of more than 7 per cent of nitric acid (calculated on a moisture-free basis) and 13 to 18 per cent in extreme cases. An interesting feature is that in some cases the underlying rock has been changed by the layer of excrement into calcium phosphate as a pseudomorph of the original calcite. Samples from a depth of 8 feet were found to contain 20 per cent of phosphoric acid below which no excavation was made.

PAHANG.

Samples of only one Pahang guano deposit have been received for analysis. This deposit occurs in limestone caves at Kampong Reman, Kuantan. The rock containing the caves is reputed to cover 100 acres of land and the guano deposits to be considerable. Table 4 shows the composition of 2 samples of Kampong Reman guano both taken from a depth of 6 feet.

TABLE 4.

Percentage composition of guano from Kampong Reman.

Description of Sample.	dark coloured.	light coloured.
Moisture -	18.9	25.3
Loss on ignition -	22.1	22.3
Nitrogen (Total) -	0.73	0.41
Phosphoric acid (P_2O_5) -	4.7	5.2
Equivalent to tricalcium phosphate ($Ca_3P_2O_8$) -	10.3	11.4

PERLIS.

The small Unfederated State of Perlis possesses by far the richest of the known guano deposits. There are reputed to be over one hundred guano bearing caves within an area of two to three square miles, while the total amount of the guano has been variously estimated at from fifty thousand to one million tons. A cave in Bukit Ketri was worked out many years ago by a Dutch Company which exported the guano to Sumatra. The guano from several caves has been sampled and the following is a description of Goa Mempi and Goa Sammy the two largest caves.

Goa Mempi contains very few bats and the deposit throughout, which is fairly dry, soft and powdery is evidently not of recent formation. The colour of the deposit varies from chocolate to buff and the depth from 3 feet to 20 feet and possibly more. The cave is approximately 200 feet in length by 50 feet in width.

Goa Sammy contains a fair number of bats, yet in no instance is there any quantity of fresh guano. In general the colour of the deposit is darker and of a deeper red than that in Mempi and also more inclined to be lumpy. The

depth of the deposit varies from a mere film to at least ten feet. A large proportion of the powdery phosphate is overburdened with a one inch crust of phosphatic rock. Goa Sammy is far larger than Mempi but no estimate of its size is possible as it consists of a large number of caves connected by a series of very narrow natural tunnels.

The following is a description of the samples analysed.

Sample number.	Cave.	Description and location.
1	Mempi	- White powder : depth of 4 feet ; 40 feet from cave mouth.
2	"	- Surface sample : 40 feet from cave mouth.
3	"	- Surface sample : 50 feet from cave mouth.
4	"	- Pocket.
5	"	- Pocket.
6	"	- Pocket.
7	"	- Small boulders.
8	"	- Chocolate coloured powder : 6"-9" deep : back of cave.
9	"	- Puce coloured deposit.
10	"	- Brown coloured rock-wafers : middle of cave.
11	"	- Grey powder containing small lumps : middle of cave : depth of about 20 feet.
12	"	- Brown powder containing lumps, with honeycomb structure.
13	"	- Brown powder : bulked sample.
14	Sammy	- Soft and muddy ; flowing down gully.
15	"	- Reddish-brown powder : cave wall.
16	"	- Light-brown powder : beneath one inch rock-crust : back of cave.
17	"	- Light-brown wafery rock : overlying sample No. 20.
18	"	- Light-brown powder containing hard lumps : adjoining sample No. 16.
19	"	- Chocolate-coloured powder containing hard lumps : depth of 18 inches, centre of cave.
20	"	- Dirty-white honeycombed rock.
21	"	- Brown powder containing lumps : beneath sample No. 18 : depth of 2 feet.
22	"	- Dark-brown powder containing soft lumps.
23	Attie	- Soft brown lumps : 25 feet from cave mouth 4 feet depth.
24	"	- Brown powder : 70 feet from cave mouth : 4 feet depth.
25	"	- Brown powder : middle of cave : 4 feet depth.
26	"	- Soft grey powder : back of cave : 3 feet depth.
27	Campbell	- Dark red powder : inner chamber : surface.
28	"	- Puce coloured powder : outer chamber : surface.

The composition of these samples is given in table 5.

TABLE 5.

Percentage composition of guano from Goa Mampi, Goa Sammy, Goa Altie and Goa Campbell.

Sample number.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Moisture	5.3	10.5	8.1	6.6	11.9	3.1	2.5	11.0	2.6	5.4	7.2	9.3	5.4	19.8
Loss on Ignition	11.0	9.1	18.4	11.2	9.2	3.6	17.6	18.6	23.1	17.2	14.0	8.3	14.7	23.4
Insoluble in mineral acid	23.6	12.2	15.1	42.7	42.6	2.5	10.9	12.8	28.6	20.4	17.0	13.1	17.0	16.9
Nitrogen (Total)	1.1	0.2	1.2	0.5	nil	0.1	0.2	...	...	...	...	...	...	...
Phosphoric acid (P_2O_5)	25.6	32.0	22.3	9.0	2.1	18.2	16.4	15.2	11.7	12.6	23.7	25.4	19.6	22.5
Equivalent to tricalcium phosphate ($Ca_3P_2O_8$)	55.9	69.9	48.7	19.6	4.6	39.8	35.8	33.2	25.5	27.5	51.7	55.5	42.8	49.8
Sample number.	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Moisture	11.6	4.4	2.7	5.0	5.1	5.0	10.2	10.0	19.8	8.4	5.5	11.2	10.9	7.3
Loss on ignition	13.6	26.7	21.8	18.2	31.7	16.8	19.4	13.0	20.1	14.7	15.8	16.9	9.2	10.9
Insoluble in mineral acid	26.0	19.1	4.4	24.7	28.2	38.8	34.5	23.8	39.7	31.9	21.0	30.7	29.8	49.4
Nitrogen (Total)	...	...	...	...	...	...	...	...	0.5	0.1	0.3	0.2	trace	trace
Phosphoric acid (P_2O_5)	22.8	18.7	36.0	28.9	20.0	13.2	19.3	16.4	2.6	19.7	13.7	10.1	12.8	8.1
Equivalent to tricalcium phosphate ($Ca_3P_2O_8$)	49.8	40.8	78.6	63.1	43.6	28.8	42.1	35.8	5.7	43.0	29.9	22.0	28.0	17.7

Qualitative analysis showed that nearly all the samples contained aluminium in varying proportions and some samples contained iron. In order to determine therefore whether the aluminium was derived from the limestone rock two samples of rock were analysed with the results as shown in table 6.

TABLE 6.
Percentage composition of limestone rock.

Description of Sample.		33	34
		Goa Mempri	Goa Sammy
Moisture	-	0.19	0.05
Loss on ignition (carbon dioxide)	-	41.61	42.45
Insoluble in mineral acid	-	2.0*	0.3*
Lime (calcium oxide)	-	55.3	57.2

* Containing no aluminium.

It is evident therefore that as the rock consists of nearly pure calcium carbonate the aluminium must have found its way into the cave by percolation and reacted with the deposit by laterisation.

In view of the supposed non-availability of phosphates containing aluminium the solubility in 2 per cent citric acid solution of several samples was carried out. The results are given in table 7.

TABLE 7.
Percentage of phosphoric acid extracted by two per cent citric acid solution.

Sample number	2	3	4	5	6	7
Phosphoric acid (P_2O_5)	15.4	trace	5.4	1.3	17.8	16.0
Whether containing iron (Fe) Aluminium (Al) or Calcium (Ca) -	Al	Ca, Al	Al	Al, Fe.	Ca	Al
Sample number.	27	28	29	30	31	
Phosphoric acid (P_2O_5)	2.5	11.8	9.6	10.0	12.2	
Whether containing iron (Fe), Aluminium (Al) or Calcium (Ca)	Al, Fe	Ca, Al	Ca, Al	Ca, Al	Ca, Al	

These figures indicate that the solubility of phosphoric acid in 2 per cent citric solution is apparently not affected by the presence of aluminium, that is to say that the availability of the phosphoric acid to the crop is unaffected by the presence in the guano of aluminium.

SUMMARY AND CONCLUSION.

Deposits of bat guano and phosphates so metamorphosed as to have passed beyond the border line dividing "guano" from "mineral phosphate," occurring in the States of Selangor, Perak, Pahang and Perlis are described and the results of analysis of many samples are tabulated.

The account is not claimed to be in any way exhaustive of either the extent of any individual deposit or of the number of deposits which exist. The deposits described are all more or less well known and no attempt has been made to make a thorough exploration. The account indicates however that Malaya has undoubtedly immense resources of naturally occurring fertilisers close at hand and that a systematic survey would be amply repaid.

Received for publication 15th May, 1926.

"SUN-SCORCH" OF EXPOSED LATERAL ROOTS OF HEVEA BRASILIENSIS.

A. SHARPLES.

RECENTLY,⁽¹⁾ attention has been drawn to an affection of *Hevea brasiliensis* both in Ceylon and Malaya the fundamental cause of which affection has been ascribed to a combination of weather conditions during the wintering period of 1925, the cumulative effect being a secondary fall of the newly developing leaves some time after wintering.

This year, 1926, an entirely different set of weather conditions has been encountered in Malaya. The usual dry period, which is helpful for a good wintering, was of long duration and the plantations were practically leafless for a comparatively long time. The usual wintering is somewhat uneven in Malaya; as a rule, some trees retain their foliage until trees wintering earlier are already producing new leaves. Thus, in most years, there is a fair amount of shade in parts of the plantation.

The weather conditions during the wintering period of 1926, were such as to produce the most even wintering in the writer's experience. The trees were leafless all at the same time, and the temperature was particularly high during the wintering period of this year.

During the last few weeks attention was drawn to an affection of exposed lateral roots, the symptoms of which suggested the well-known symptoms of lightning-strike or scorching. The disease was first noted on a hilly estate, where the lateral roots on the hillsides were likely to be more exposed than on flatter land. On these exposed roots, slight cracks appeared in the bark, which on further examination, showed a much greater extension of apparently scorched and dead, dry bark than the cracks in the bark would indicate. Wounds, often two feet in length, had to be made to clear out the diseased tissue. The wood beneath the dead bark showed the usual, greyish discoloration typical of *Hevea brasiliensis* when attacked by the *Diplodia* sp. which causes the "Die-back" of branches of *Hevea*. The wood was not penetrated to any great depth, the deepest being about one inch, but the wood penetration went beyond the limits of the dead bark. The fungus was progressing slowly along the wood, and not in the bark. A yellowish discoloration was often seen on the inner boundary of the greyish, discolored wood.

At first, the affection seemed to warrant serious attention for a 10% infection was counted. Besides this high

(1) Sharples A. *Hevea* Mildew in Ceylon and Malaya. *Malayan Agricultural Journal* Vol. XIV. April 1926. No. 4.

percentage infection, the rapid and often serious effects of lightning-strike had to be taken into consideration; when the cortex of the trunk is scorched over the whole length of the tree, as by lightning, the progress of the *Diplodia* fungus is very rapid and death may ensue very quickly. As mentioned above, the fact that extension was taking place in the wood, and not in the cortex, was a matter for satisfaction.

Little could be done except to advise measures for cleaning out the diseased tissues and preventing further spread. Specimens were obtained in the laboratory and isolations and inoculations were undertaken. The isolations all yielded the expected *Diplodia* sp. The inoculations, both in wounded and unwounded roots, with large portions of diseased tissue were negative 14 days after inoculation. This led to the conclusion that, only under exceptional conditions, was the disease likely to spread rapidly.

In the search for contributory causes the question of the apparent scorching was not easily answered. No fires had been reported and although lightning plays many pranks, the position of the wounds and distribution precluded this explanation. There have been no previous records of "Sun-scorch" but this seemed to afford the likeliest explanation and there seems little doubt when the distribution of the disease is studied from this standpoint that "Sunscorch" is the main contributory cause of this particular affection.

If the hilly divisions with an East and West frontage are considered, it is found that starting out from the East face no cases of scorched exposed lateral roots could be found. As a move is made round the hill to the west a few isolated, lightly affected cases will be found, until the west face is reached, when several trees in the same row often will be found affected. If a move is made from East to West over the top of the hill, the same phenomena are met with; no cases on the East, a few isolated cases on the top, then a heavy infection on the west side. Moreover, on single trees with several roots exposed all round the tree, those facing west are heavily affected, while those on the Eastern side which would be shaded by the trunk during the hot afternoon sun, were not affected or only very lightly affected. The evidence collected in this manner appears conclusive, the explanation being that trees with exposed lateral roots situated on a slope facing West, received the direct rays of a very hot afternoon sun, during a period when the trees were leafless and shade was absent, owing to the extraordinary, even wintering of 1926. The scorched areas are next attacked by the *Diplodia* sp. common on rubber, which rots the bark and penetrates slowly in the wood.

In advising control measures, care had to be taken to see that the fungus had not penetrated into the trunk of the

tree. Some of the wounds on the lateral roots initiated by sun-scorch, were almost in contact with the stem; numbers of these were cut as near the trunk as possible but in no case was there any definite penetration into the trunk of the tree.

The best form of treatment would be the excision of all the attacked wood and cortex. On a large percentage of roots this would hardly be feasible, as the scorching often produced several wounds on an individual root; these have later joined together to produce a diseased area many feet in length. Such a length of diseased wood would be difficult to excise and in such cases it would be a better plan to cut through the root in healthy tissue, take the diseased root out of the ground and burn. Where wounds are small, the diseased tissue can be chiselled out with broad, flat chisels, the exposed surfaces painted with a strong solution of Solignum or Jodelite, to be followed later by a generous application of Tar.

On some estates shortage of labour may interfere with the progress of the work of excision and some simpler method may be advisable. Even in the early stages the healthy cortex is forming a broad callus edge round the diseased wound and natural recovery may be possible in many cases. On one estate, no excision of diseased wood is being done: the scorched and dead bark is cleaned away thoroughly and in this connection, care must be taken to cut down the callus tissue, which overhangs to form a cavity, level with the wood surface. If this is not done, the preventive paint will not reach the tissue protected by the overhanging callus, and water may collect in the cavity. Such a condition would be most favourable for the entry of some of the more serious wood-rotting organisms which are partial to *Herca*, and considerable damage might be done. Having scraped away the loose decayed cortex, and cut down the callus edges, the exposed surfaces are painted directly with a mixture of 50 % Tar and 50 % Solignum.

It is too early to report fully upon the respective merits of these methods. A later report will be issued.

NOTE: Since going to press the typical symptoms have been reproduced in inoculation experiments when the bark of exposed lateral roots is, previous to inoculation, scorched by fire. In some cases the scorching alone is sufficient to initiate the disease, as was shown by the control experiments, in which no inoculating material was used. A further report will be issued on completion of the inoculation experiments.

THE EFFECT OF FERN AND OTHER GROWTH ON THE HEALTH AND GROWTH OF THE RUBBER TREE.

F. G. SPRING.

THE writer recently visited seven estates for the purpose of inspecting rubber trees growing in areas under ferns and to arrange, if possible, for experimental work to be undertaken which might throw some light on the health and growth of the rubber tree in fern areas.

In the writer's opinion, only on one of these estates is there, any evidence to support the argument that ferns are harmful to the rubber tree. The trees on this property, are very backward in growth and have not the healthy appearance of those growing in adjacent clean weeded areas. The leaves have a pale unhealthy colour, the tips of several of the branches are dead and the rubber can only be described as very poor. There is a small amount of lallang but whether it is present in sufficient quantity to be an influencing factor is questionable. The ferns are about four feet in height and have afforded dense cover for the past eight or nine years. This is far too long a period without cutting the ferns back. On the estates where they are cut back periodically no harmful results were found; how often cutting back is necessary is a matter for investigation.

Ferns provide an effective cover for the prevention of soil wash and are particularly valuable on areas where other vegetation is difficult to establish. They also retard the growth of lallang and keep the soil in a soft, moist condition.

The trees on all the estates visited with the exception of those on the property mentioned, look healthy and are well grown. The foliage is generally excellent and the bark thick and succulent. In the absence of experimental data, however, it is only possible to express an opinion that ferns are not harmful, in old rubber areas, provided the cover is free from lallang or other noxious weeds and is cut back occasionally. It is hoped that the tests about to be undertaken will throw light on the subject and provide some definite information as to the value or otherwise of ferns as a cover plant. The type of fern or moss best suited for the purpose requires investigation. Tall growing ferns must be cut back periodically, if left for a long period the remaining stubble is so strong that it is difficult for labourers to work, in any such area, without injury to the feet. Cutting is best done at the commencement of a wet season in order that the material may be left on the land without danger of fire. Tall growing ferns, if never cut back, are objectionable on account of the difficulties of supervision and the labourers work.

Estate A.—1913 planting consists of 60 acres under ferns. The land is undulating and hilly with an outcrop of laterite on the top of one of the hills. The soil is a sandy loam, the distance of planting 20' by 20' and the system of tapping a single V, on half the circumference, alternate day tapping. This field was in tapping from May, 1919, to October, 1920 and the yield over this period is given at the rate of 162 lbs. per acre, per annum. The field was rested until December, 1925, when the trees were reopened and the yield from December to February works out at the rate of 576 lbs. per acre, per annum. A sample of 200 c.c. of latex yielded 70.5 grms. of dry rubber = 35% dry rubber content, and a sample of virgin bark taken at a height of 3 feet from the ground shows 14 latex vessels. In the 1913 clearing there are no catch-pits except on the top of one of the hills where ferns will not grow. Ferns have been used as a cover crop since 1922 and cut back annually. A certain amount of damage has been done by soil erosion but the damage would have been greater had precautions not been taken to reduce soil wash by growing a cover over the land.

1917 planting is very hilly with an outcrop of rock where the growth of the trees is backward. On the less steep slopes and undulating areas, the trees are in first class condition. Tapping was commenced on the 1st February, 1926, the system being a V, on half the circumference, alternate day. The ferns on the steep slopes have proved beneficial in respect of soil erosion.

In the 1920 area, ferns have been grown as a cover crop for the past 18 months. The land is undulating and the soil a sandy loam. This area contains beautifully grown trees.

General remarks on Estate A.—The general appearance of the trees other than on the tops of the hills is exceptionally good, they are well-grown having excellent trunk, branch and leaf development. The colour of the leaves is a dark green healthy one. The bark is worthy of special comment, being unusually thick and succulent. The field appears to be exceptionally free from disease. The trees compare favourably with the best rubber areas in the country. The manager thinks that the foliage and bark have improved considerably during the time ferns have occupied the land. The ferns are cut down once a year, which may be important. It is wise not to undertake this during a dry season in case of fire.

Estate B.—The trees are 10 years old. The soil is a light clay loam and the land very hilly. The distance of planting is 18' by 18'. The land was originally a tapioca area and subsequently under lallang. Previous to rubber planting, the lallang was cleared in rows and trees planted in the clean rows. These were maintained clean weeded for three years when the area was neglected and ferns gradually

killed out most of the lallang. At present the vegetation consists of numerous types of ferns (some of which are four feet high) a small amount of blukar and lallang. Owing to this heavy undergrowth there has been little or no soil wash even on the steeper slopes.

Area A.—This field was cleared of ferns, blukar and lallang three years ago when tapping commenced and has been maintained clean weeded ever since.

Areas B & C.—The ferns, blukar and lallang have recently been cleared for the first time.

Area D.—Still remains under fern, blukar and lallang which has never been cut back. Trees untapped.

The trees in area D (this area has been under ferns for eight or nine years) are unquestionably backward and they have not nearly as good an appearance as the trees in area A which has been maintained clean weeded for the past three years. Areas B & C have recently been cleared and there is already evidence of a recent improvement of the trees particularly in respect of the foliage as compared with trees in area D which still remains under cover. It is hard to say what is the factor limiting growth but in this particular instance it may not be a question of soil conditions in view of the two recently cleared areas (B & C) being adjacent to D and apparently under similar conditions. The backward growth and poor appearance of trees in area D is possibly owing to the land having been left too long under ferns which have never been cut back. A sample of virgin bark taken at a height of 3 feet from the ground shows eleven latex vessels.

Estate C.—This estate was planted in the years, 1918 and 1919. The soil is a sandy loam and the land undulating but very hilly in parts. Distance of planting 20' by 20'. The area is not silt-pitted. System of tapping, basal V, over half the circumference, alternate day. The area of 250 acres was originally under lallang. The lallang was cleared in preparation for rubber planting and the land clean weeded for a few months but soil erosion was so bad that ferns were allowed to grow as a means of prevention. Ferns were grown until February, 1926, when they were cut out during February and March. Tapping commenced in January, 1926. On the steeper slopes, the ferns have proved valuable for retaining the top soil. They were cut back about 23 months ago and again in September, 1925. Height of fern growth from 3 to 4 feet. The cover consists chiefly of ferns but there is a little blukar and lallang. On the whole, the trees are well grown for their age, many of them having exceedingly good trunks. The branching and foliage are good and the condition of the bark satisfactory. In some areas the trees are as well grown on the tops of the hills as they are in the undulating areas. There are a few backward fields but

on the average the trees are of normal growth for their age and fairly uniform in size. A sample of 200 c.c. of latex gave 60 grms. of dry rubber = 30 % dry rubber content. A sample of virgin bark, taken at a height of three feet from the ground, shows 19 latex vessels.

Estate D.—The rubber trees in field 1, 138 acres were planted 30' by 15' in 1919, on very hilly land. The soil is a clay loam. The area has been continuously under ferns and grass except for a few months after planting. The cover is cut back once in two months at a cost (over the whole estate) of 60 cents, per acre, per month. The land has contour drains and terraces spaced 30 feet apart. Only the terraces are maintained clean weeded. There has been comparatively little soil wash. The trees look healthy and are well grown. The foliage is abundant and is of a dark green colour. The virgin bark is thick and soft and the renewal good. An examination of the surface layers showed the soil to be in a nice soft, damp condition. A sample of 200 c.c. of latex yielded 49 grms. of dry rubber = 24 % dry rubber content. A sample of virgin bark taken at a height of 3 feet from the ground shows 8 latex vessels.

Tapping was commenced in November, 1923, at a height of 14 inches from the ground, basal V over half the circumference, alternate day. Bark consumption $\frac{3}{4}$ of an inch per month. Three hundred trees tapped per coolie. The yield was 217 lbs. of rubber, per acre, over 242 acres, all planted in 1919. Ninety per cent. of the trees are in tapping.

Estate E.—The trees are ten years old, planted in a light sandy loam, area 85 acres. The land is hilly but there has been very little soil erosion. Light ferns and grass have occupied the area from the early stages of development of the property. This vegetation is cut back once a quarter. The trees are very well grown, having good trunks, branch and leaf development. The virgin bark is thick and renewal satisfactory. The trees look healthy and do not appear to have suffered in any way from the effects of fern growth. A sample of 200 c.c. of latex gave 74.5 grms. of dry rubber = 37 % dry rubber content. A sample of virgin bark, taken at a height of 3 feet from the ground, shows 14 latex vessels. Tapping was commenced on the 8th March, 1925, on a $\frac{1}{2}$ spiral, alternate day system. Bark consumption $\frac{3}{4}$ of an inch a month. Number of trees tapped per coolie 300. From the 1st April, 1925 to 31st March, 1926 a yield equivalent to 400 lbs. per acre, was obtained.

Estate F.—The area of 120 acres under ferns was planted up in 1918. The soil is a rich loam with the exception of one or two outcrops of laterite. The land is hilly and undulating. Trees spaced 20' by 20'. The appearance of the trees is unquestionably very fine and compares favourably with those in adjacent clean weeded areas. They are

of the reddish barked type and are well grown in all respects. There was no evidence of ill effects from fern growth. Virgin bark thickness and renewal are exceptionally good. Ferns, mostly bracken, have occupied the land for the past three years. They were cut back in August, 1925 and subsequently strip weeding was done once in two months at a cost of 50 cents, per acre.

The yield of rubber for January, February and March, 1926, works out at 320 lbs. per acre, per annum. Tapping commenced in September, 1925, on a V half the circumference, alternate day. Bark consumption $\frac{7}{8}$ of an inch a month. Four hundred trees tapped per coolie. The manager of this estate considers that rubber trees growing amongst ferns give equally as high a yield of rubber as trees growing in clean weeded areas. 200 c.c. of latex gave 65 grms. of dry rubber = 32% dry rubber content. A sample of virgin bark taken at a height of 3 feet from the ground shows 10 latex vessels. All bark and latex samples were taken, on all the estates, from average yielding trees.

Estate G.—Field F. 95 acres was planted in November, 1912. The land is hilly and the soil a sandy clay loam. Distance of planting 17' by 17'. This field has been under fern growth for the past five years, which has never been cut back. The ferns were about $4\frac{1}{2}$ feet in height. In March, 1926, a start was made to eradicate them in order to facilitate tapping and supervision. This cost \$8/- per acre to eradicate. Comparing the trees in this field, with adjacent trees of similar age in clean weeded areas there was no appreciable difference in any respect and according to the manager, the yields of rubber are, as far as he can judge, about equal.

Rubber Small Holdings.—The writer inspected many thousands of acres of small holdings throughout the Peninsula in which the rubber trees are growing amongst grass, ferns and blukar and in many instances I have been impressed with the good appearance of the trees and the fine condition of the bark particularly in blukar areas. In this connection the undermentioned reports are of interest:—

NATIVE RUBBER CULTIVATION IN THE DUTCH EAST-INDIES.

Western Division of Borneo.

“Interplanting of rice is a very general practice; as a rule it is done for 2 years, sometimes for a year only, rarely for a longer period. Thereafter blukar, harmless weeds, etc. are allowed to grow up and once or twice a year are cut down. Rubber of two to three years old sometimes stands in blukar of such density that it is hard to find; yet that does not seem to have any detrimental influence on the rubber's development.”

NATIVE RUBBER CULTIVATION IN THE DUTCH EAST-INDIES.

“Rubber of only a few years old is scarcely recognisable because the land after the paddy-harvest is simply abandoned. Lallang occurs sporadically only so that the young rubber develops among secondary-forestgrowth, so-called “blukar”; one may even pass a young rubber-field without knowing it. Anyone who has spent a day in such environment is for ever cured of any intentions to have the young fields surveyed or the trees counted. The young trees are simply left alone for 5 to 8 years; at what age tapping is started depends on the market price of rubber and on the question whether or not older fields are available for tapping.

During the third quarter of 1924 prices were not so high that there was any inclination for tapping to the utmost; they were then Gs. 30—40 per picul. In many cases full development of the trees was waited for, say a girth of 20 inches at 1 yard over ground-level.

To bring the trees into tapping it is however necessary to make room for going about easily and tapping easily. The blukar has to be cut down; sometimes the owner himself will do this, sometimes he hires labour. How this is arranged, depends on the economic conditions of the village which are often rather complicated and which a passing traveller never learns; no approximately accurate description thereof is available either.

The rubber trees will then be found to have developed quite well; the branches of course start at rather great height, but the bark is thick and soft and often a good deal better than on many a well kept estate. The girth of the trees is of course less than the girth of trees on estates of the same age, but the Jambee native does not care. His policy more and more is to plant new fields every year and he simply waits another year; his capital is time, not money.

Damage is occasionally done by deer, but the trees recover splendidly.”

Received for publication 12th May, 1926.

FURTHER NOTES ON THE BRAZIL NUT TREE IN MALAYA.

W. N. SANDS.

DURING last year the writer visited the herbaria of the Royal Botanic Gardens, Kew, and the British Museum in the endeavour to establish the identity of the species of *Bertholletia* which fruits well and regularly in the Kuala Lumpur Experimental Plantation, but this endeavour was unsuccessful as the botanical material of the genus was poorly represented in these herbaria; however, botanical specimens from the Kuala Lumpur trees were presented to Kew, and when forwarding the material to the Director of the Royal Botanic Gardens, the writer mentioned that in looking up the literature on the subject the conclusion had been reached that the species growing in the Kuala Lumpur Experimental Plantation, which was originally sent out from Kew in 1912 as *Bertholletia excelsa*, is *B. nobilis*, Miers., judging from Miers' (1) description of the fruit of each species. Although certain of the vegetative characters of *B. nobilis* as described by Miers did not fit very well, it was thought that this might be readily explained if Miers had not had an opportunity of studying the living plant. It was also mentioned that numerous fruits from the trees growing locally had been examined but each one had the opercular opening definitely widening considerably inwards with the operculum remaining inside it.

In a letter dated 30th November, 1925, from the Director of the Royal Botanic Gardens, forwarding a memorandum by Mr. T. A. Sprague of the Kew Herbarium on the subject, the Director states that "the question of the correct names of *Bertholletia* is quite an interesting story, from which it appears probable that there is only one species. Unfortunately, as with so many of these tropical trees, we have not sufficiently full material to enable us to say definitely whether there is one or whether there may be two plants. If there are two, it is very possible that the second is different both from *Bertholletia excelsa*, Mart., and *B. nobilis*, Miers."

The following is a copy of Mr. T. A. Sprague's interesting memorandum:—

FRUITS OF BERTHOLLETIA FROM KUALA LUMPUR.

"The two fruits received confirm Mr. Sands' view that the Kuala Lumpur tree is *Bertholletia nobilis* Miers. It is *B. nobilis* which yields the Brazil-nuts of commerce, as has been indicated by W. J. Young (Bot. Gaz. lii. 226-231:

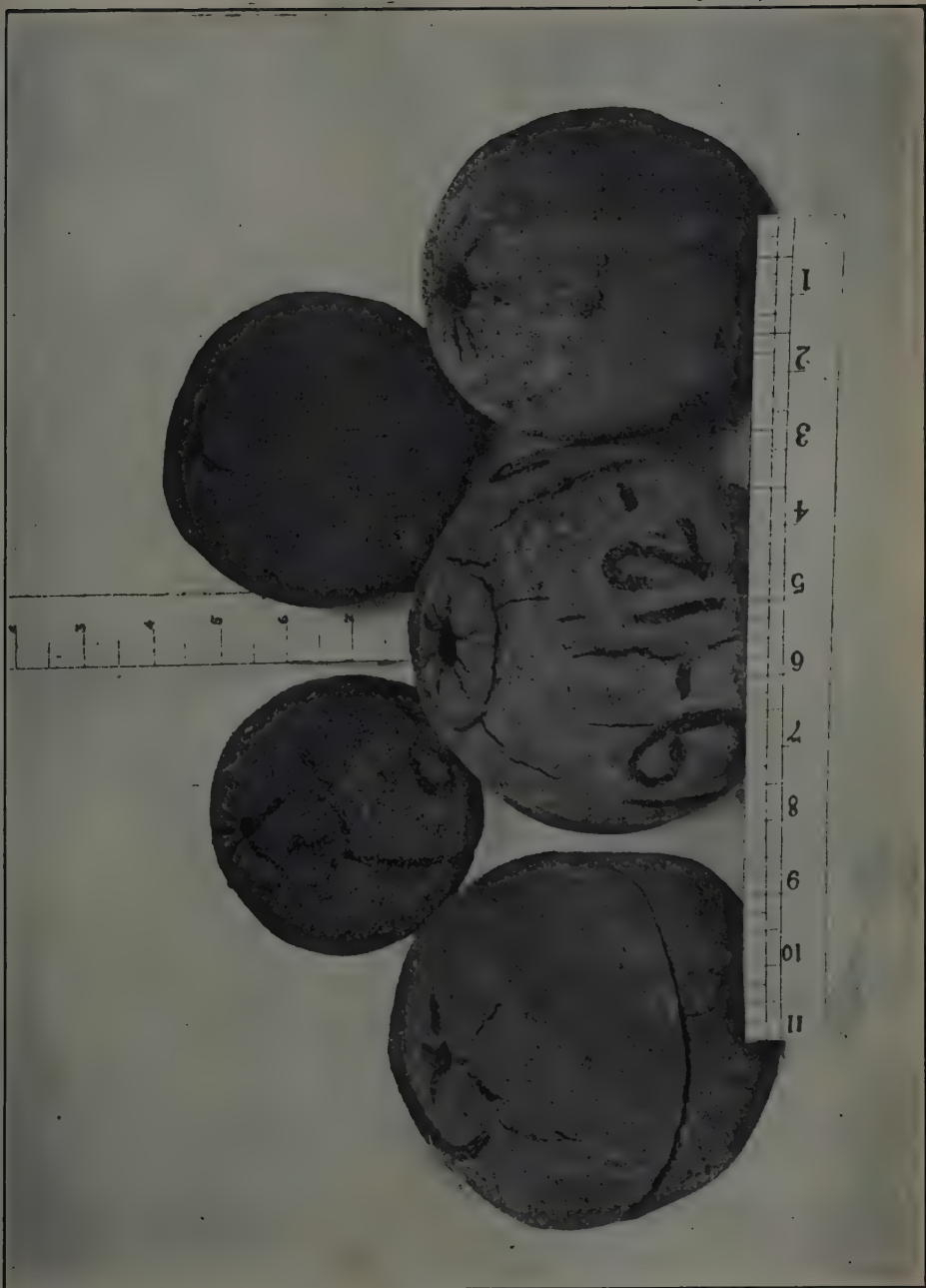
(1) Miers. J.—On the Lecythidaceae Trans. Linn. Soc. XXX pp 157-318;

1911). Young's identification is confirmed by a study of the fruits in the Kew Museums. It is however, doubtful whether *B. nobilis* is really distinct from *B. excelsa*.

Bertholletia excelsa was originally described by Humboldt and Bonpland (Pl. Aequinoct. 122, t. 36: 1805; H.B.K. Nov. Gen. vii. 260), from specimens collected in the neighbourhood of Esmeralda in the Upper Orinoco. Their illustration of the fruit was incomplete, the operculum not being shown. Poiteau redescribed and figured *B. excelsa* from trees cultivated in French Guiana and mentioned that the operculum fell within the fruit (Mem. Mus. Par. xiii. 148, t. 4). Berg also redescribed and figured *B. excelsa* (Mart. Fl. Bras. xiv. pars 1, 478, tt. 60, 61: 1858). Miers (Trans. Linn. Soc. xxx. 196: 1874), considered that there were two species of *Bertholletia*, *B. excelsa*, and *B. nobilis* Miers, the latter name being applied by him to Berg's *B. excelsa*. According to Miers, the operculum of *B. excelsa* falls off *outside* the fruit, whereas in *B. nobilis* it falls inside. This distinction appears to have no foundation in fact. The only fruit cited by Miers under *B. excelsa* was one in the Kew Museum "in Trinidade introd. (Purdie)." There is no fruit in the Kew Museums with an external operculum as figured by Miers, but a fruit which was received from Purdie in 1851 agreed fairly well in other respects with Miers's illustration, of which it is apparently the original. Other distinctive characters mentioned by Miers do not hold even for the specimens which he himself cites. Thus Martius' specimen which Miers cites under *B. nobilis* ("petiole 3-6 lines long"), has two leaves, one of which has a petiole 12 lines long, a character, according to Miers, of *B. excelsa* ("petioles 9-18 lines long"). It should be remembered that Miers was eighty-five years old in 1874, the year in which his paper on the *Lecythidaceae* was published. Petch (Ann. Bot. Gard. Peradeniya, v. 421-431: 1914), as the result of the study of a living tree at Peradeniya, came to the conclusion that there is only one species of *Bertholletia*, and the same conclusion was reached by Deshmukh at Singapore (Gardens' Bulletin Straits Settlements, ii. 437: 1921).

Mr. Sands himself (Malayan Agricultural Journal, X. 130-132: 1922), considered that all the trees cultivated at Kuala Lumpur were of one species, and mentioned that there was variation in the size and shape of the fruits.

From a consideration of all the evidence available it seems probable that there is only one known species of *Bertholletia*, namely *B. excelsa*, *B. nobilis* being a synonym. As the original specimens of *B. excelsa* were very incomplete, however, it is desirable that further material of the tree should be obtained from the neighbourhood of Esmeralda, the original locality. There is a bare possibility that the "Juvia" of the Upper Orinoco (*B. excelsa*) may be different from the "Castanheiro" of the Lower and Upper Amazons (*B. nobilis*).





It may be mentioned that there are to-day twelve trees in full bearing in the Kuala Lumpur Brazil-nut plot, and all of these have the general fruit characters of *B. nobilis*. It is of interest to note that the fruit from individual trees is quite distinct in respect of size, shape, size of opercular opening, size and shape of operculum, size of nuts and in other ways; this will be readily observed in the photograph (Plate I) where five typical fruits from five different trees, numbers 1, 10, 19, 2 and 36, are shown. Whilst the photograph (Plate II) clearly shows the regular size and shape of fruits collected from tree No. 19.

As a large fruit produces as many, or more, bigger, much heavier and better nuts than a small one, it would be desirable to select the best seed-nuts from individual trees for planting purposes, notwithstanding the fact that the flowers are open to cross-pollination by the large Carpenter-bee (*Xylocopa latipes*, Dr.) and perhaps other heavy-bodied insects.

Although several attempts have been made to reproduce the tree by a-sexual methods, none of these has so far been successful.

Additional information concerning the Brazil Nut in Malaya will be found in Vol. X, No. 3, pp. 87-88 and Vol. X, No. 5, 130-132 of this Journal.

REFERENCES TO PLATES.

Plate I.—Shows the variation in size and shape of typical fruits from five Brazil-nut trees growing in the Kuala Lumpur Experimental Plantation. Numbers of trees, left to right, are 1, 10, 19, 2 and 36. The fruit of Number 1 was cut open for examination before the photograph was taken.

Plate II.—Typical specimens of fruit from Brazil-nut Tree Number 19, growing in the Kuala Lumpur Experimental Plantation. In the foreground is shown a fruit which was cut open to show the characters of the shell, opercular opening, operculum and nuts.

Received for publication 28th January 1926.

LONDON MARKET PRICE LIST 1st QUARTER 1926.

Oil Seeds.

Castor (Bombay)	- £17.17.6 to £18.17.6 per ton.
Copra (Ceylon)	- £30.10.0 "
Do. (Straits)	- £28.12.6 to £29.15.0 "
Croton	- £1.7.6 to £1.12.6 per cwt.
Desiccated Coconut (fine)	- £1.19.0 "
Do. Do. (medium)	- £1.19.0 "
Do. Do. (coarse)	- £2.3.0 "
Linseed (Bombay)	- £17.17.6 per ton.
Do. (Plate)	- £14.12.6 "
Palm Kernels (West African)	- £20.2.6 to £20.10.0 "

Oils.

Castor (first pressing)	- £43.15.0 to £45 "
Coconut (Cochin)	- £56 to £58 "
Do. (Ceylon)	- £47.10.0 "
Cotton Seed (Egyptain crude)	- £34 to £35 "
Palm (Lagos)	- £38.12.6 to £38.10.0 "
Palm (kernel)	- £43 "

Oil Cakes.

Coconut	- £8.7.6 to £8.10.0 "
Cotton (Egyptain seed)	- £6.2.6 to £5.15.0 "
Do. (Bombay seed)	- £4.17.6 to £5 "
Ground nut (London decorticated)	- £11 to £12.7.6 "
Linseed 9%	- £12 to £12.5.0 "
Palm kernel	- £6.10.0 to £7 "

Essential Oils.

Cajeput	- 2/7 to 2/9 per lb.
Camphor (Chinese, crude)	- 2/6 "
Do. (Japanese, refined)	- 2/8 to 3/6 "
Camphor oil (white distilled)	- £2.13.6 per cwt..
Cinnamon (Ceylon leaf)	- 5/7½ per lb.
Citronella (Ceylon)	- 1/10 to 1/11 "
Do. (Java)	- 2/8 to 3/1 "
Clove	- 6/3 to 6/9 "
Lemon Grass (Cochin)	- 3/11 to 4/2 "
Lime (West Indian, distilled)	- 15/0 to 20/0 "
Patchouli (Penang)	- 18/0 to £1.1.6 "
Do. (Mysore)	- £1.10.0 "
Vetiver (Bourbon)	- £2.5.0 to £2.12.0 "

Spices.

Capsicums (East Indian)	- £2 to £2.5.0 per cwt.
Do. (Nyassaland)	- £3 to £3.10.0 "

Spices.—Contd.

Chillies (Zanzibar)	- £1.17.6 to £2.5.0	per cwt.
Do. (Nyassaland)	- £2.10.0 to £3.5.0	„
Do. (Japan)	- £5.10.0 to £5	„
Cinnamon (Ceylon)	- 1/9	per lb.
Cloves (Zanzibar)	- 10½/- to 1/0	„
Do. (Penang)	- 2/0 to 2/6	„
Ginger (Japan)	- £4 to £3.10.0	per cwt.
Do. (Jamaica)	- £3.10.0 to £5.10.0	„
Mace (Bombay & Penang)	- 3/10 to 4/0	per lb.
Nutmegs (Singapore & Penang)	-	
110's	- 2/2 to 2/1	„
80's	- 2/6 to 2/3	„
64's-57's	- 2/7 to 2/8	„
Pepper (Singapore black)	- 1/3½ to 1/1	„
Do. (Do. white)	- 1/6 to 1/4	„

Drugs.

Ipecacuanha (Rio)	- 14/0 to 14/6	per lb.
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Natural Dyestuffs & Extracts.

Annatto	- 5d to 6½d	„
Gambier (block)	- £2.15.0	per cwt.
Do. (Cube)	- £3.15.0	„

Gums and Resins.

Damar (Singapore)	- £1.18.0 to £7.15.0	per cwt.
Do. (Batavia)	- £6.5.0 to £7.15.0	„
Dragon's Blood (reeds)	- £15 to £20	„
Guttapercha (genuine)	- 2/9 to 6/0	per lb.
Do. (Sarawak)	- 3/0 to 4/0	„
Do. (Siak reboiled)	- 1/4 to 1/3	„
Jelutong	- 1/0 to 1/6	„

Fibres.

Cotton (American Go to Mid.)	- 7.38 to 10.81	per lb.
Do. (Egyptian Skellarides G.F. to Fine)	16/65 to 20.40	„
Hemp (Manila "J" Grade)	- £45.5.0 to £44.0.0	„
Do. (Mauritius)	- £36 to £40.10.0	„
Do. (New Zealand)	- £36 to £40.10.0	„
Do. (Sisal)	- £22 to £48	„
Kapok (Indian)	- 1/0 to 1/2	„
Do. (Java)	- 1/3½ to 1/5½	„

Cocoa (Ceylon, plantation)	- £4.0.0 to £5.0.0	per cwt.
Coffee (Malay, plantation)	- £5.10.0 to £6.10.0	„
Do. (Do. Liberian)	- £5.0.0 to £5.5.0	Nom. „

Foodstuffs.—Contd.

Sago (pearl)	- £1.8.0	per cwt
Do. (flour)	- 17/6 to 18/6	"
Sugar (Java, white)	- £1.6.6 to £1.6.9	"
	(excluding duty)	
Tapioca (Penang, flake)	- 2d to 3d	per lb.
Do. (Do. flour)	- £18 to £1.2.0	per cwt.

Chemicals.

Acetic acid (glacial)	- £67	per ton.
Do. (80% com)	- £37.0.0	per cwt.
Acetone	- £81.0.0	per ton.
Ammonia (880)	- £21.0.0	"
Calcium Acetate (grey)	- £17.10.0	"
Citric Acid	- 1/3½	per lb.
Formic Acid (85%)	- £49.0.0	per ton.
Formalin (40% Vol)	- £40.0.0	"
Lime Juice (Cone)	- £20.0.0 to £21	Nom.
Sodium bisulphite (60-62%)	- £17.0.0	"
Sodium Sulphite (anhydrous)	- £14.0.0	"
Wood Creosote (unrefined)	- 2/9	per gal.

The market has declined since the last quarter for castor, cottons and crotons oil seeds; Copra however, remains firm with a steady demand. Oils, generally, have also remained steady. Oil cakes of all descriptions are markedly easier with the exception of palm kernels which have remained firm.

Of essential oils patchouli oil is in strong demand; most other oils are easier.

Spices call for little comment: pepper of all grades has steadily declined, most other spices remaining quiet.

Annatto is quoted at a nominal price no sales being recorded: gambier remains quiet at lower prices over those ruling at the end of 1925.

There has been little demand for damar, and heavy supply of Dragon's blood is reflected on the prices for this commodity. The guttapercha prices are well maintained.

All fibres have dropped considerably, especially cottons: kapok alone has appreciated.

Foodstuffs and chemicals call for no comment.

A comparison of the figures for the last quarter of 1925 shew that markets for most of the commodities have been rather lifeless: further declines in products used in manufacture are certain during the second quarter of this year, owing to labour troubles in England.

Fertilizers are likely to be of ever increasing interest to planters in Malaya, and in view of this fact, the following note, abstracted from

"The Fertilizers and Feeding Stuffs Journal" February 1926, on the 1925 market for fertilizers, is of value.

"The average level of prices for both fertilizers and feeding stuffs were again lower last year, fertilizers as a whole were only 14% dearer in 1925 than in the period 1911-13. The tendency to a further general decline in price levels during the past year is emphasised by the fact that, among fertilizers, only basic slag and potash hardened in value, kainit then selling on practically a pre-war basis, whereas of food stuffs oats and brewers' grains alone showed higher prices for feeding stuffs".

Note.—The above market price list is based on various issues of the following journals published during the first quarter of 1925. Lewis and Peat Monthly Prices Current : Lewis and Peat, West Indian, Central American and Brazilian Monthly Market Report : Tropical Life : British Trade Journal : Fertilizers and Feeding Stuffs Journal : Chemist and Druggist : Chemical Trade Journal : Chemical Age : Perfumery and Essential Oil Record. The figures merely aim at indicating the trend of prices over the period, as a guide to future movements.

Received for publication 15th May 1926.

Publications of the Department of Agriculture.

The following publications, except those out of print, may be obtained on application to the Office of the Secretary for Agriculture; and the Malay States Information Agency, 88, Cannon Street, E C. London.

A remittance to cover the cost should accompany applications; otherwise the Journals will be sent by post, Cash on Delivery, where that system is in force.

1. The Agricultural Bulletin F.M.S.

Vols. I--IV (1913-16) VIII & IX (1920-21) price \$5.00 per volume.

Vol. V (1917) Nos. 1, 2, 3, 5 & 6 „ 250 per set.

„ VII (1919) „ 2-6 „ 450 „

(Vol. VI is out of print.)

2. The Malayan Agricultural Journal (continuing the Agricultural Bulletin) Published monthly.

Vol. X (1922) Price \$5.00 per volume.

„ XI (1923) Price \$5.00 per volume or 50 cents per single number.

„ XII (1924) „ „ „ „

Back numbers of Vols. I—X will not be sold singly.

3. The Handbook of Malayan Agriculture, price \$1.00.

Current numbers of the Malayan Agricultural Journal and the Handbook may be purchased from the Railway Bookstalls and Branches of Messrs. The Federal Rubber Stamp Co.

4. Special Bulletins.

1. Notes on *Termes Gestroi* and other species of Termites found on Rubber Estates in the Federated Malay States, by H. C. Pratt, 1909, 20 cts.
2. Root Diseases of *Hevea Brasiliensis*, by W. J. Gallagher.
3. Observations on *Termes Gestroi* as affecting the Para Rubber Tree and methods to be employed against its Ravages, by H. C. Pratt, 1910, 20 cts.
4. *Brachartona catoxantha*, Hamps, by H. C. Pratt, 1909.
5. The Extermination of Rats in Rice Fields, by W. J. Gallagher, 1909.
6. Branch and Stem Disease of *Hevea Brasiliensis*, by W. J. Gallagher, 1909.
7. *Coffea Robusta*, by W. J. Gallagher, Government Mycologist, 1910, 20 cts.
8. The Cultivation and Care of the Para Rubber Tree (in Malay) 1910.
9. Die-Back Fungus of Para Rubber and of Cacao, by K. Bancroft, 1911.
10. A Lecture on the Para Rubber Tree, by W. J. Gallagher, 1910.
11. Coconut Cultivation, by L. C. Brown, 1911
12. Padi Cultivation in Krian, by H. C. Pratt, 1911
13. A Root Disease of Para Rubber, *Fomes Semitostus*, by K. Bancroft, 1912, 20 cts.

MAP OF
BRITISH MALAYA
 SHEWING DISTRIBUTION
 OF
 AGRICULTURAL STAFF
 PLANTATIONS & RESERVES



DRAWN & PRINTED BY F. M. S. SURVEYS NO. 49 - 1926.

Section B. Rubber, Gums & Resins.

Class No.	Nature of Exhibit.	Quantity.	Prizes.		
			1st.	2nd.	3rd.
250	Para Pale Crepe -	1 case, not less than 150 lbs.	G.M.	S.M.	B.M.
251	„ Smoked Sheet -	„	G.M.	S.M.	B.M.
252	„ Compo Crepe -	„	S.M.	B.M.	Dip.
253	„ Sole Crepe -	„	Cup	B.M.	Dip.
254	„ 1st Grade Rubber prepared in any other form -	„	S.M.	B.M.	Dip.
255	Para Smoked sheet (Open to privately owned estates not above 100 acres)	50 lbs.	S.M.	B.M.	Dip.
256	Para Smoked sheet (Open to Asiatic holdings under 10 acres only) -	10 katies	{ Dip. & \$10	{ Cert. & \$5	{ \$3
257	Para Unsmoked sheet (Open to Asiatic holdings under 10 acres only) -	10 „			
258	Any other rubber (plant to be named)	2 „	{ \$10	{ \$5	{ 3
259	Locally manufactured rubber goods :		{ \$5	{ 3	{ 2
	(a) Raw Rubber Articles -	Optional	Dip.	Cert.	—
	(b) Vulc. Rubber Articles -	Optional	G.M.	S.M.	B.M.
260	Jelutong -	10 katies	Dip.	\$3	\$2
261	Gambier, Cubes -	3 „	Dip.	3	2
262	Gambier, bale -	3 „	Dip.	3	2
263	Dragon's Blood -	1 kati	\$5	3	2
264	Gums, Damar, best collection of local	„	{ Cert. \$5	{ 3	{ 2

ENTRANCE FEES.

Class Nos. 250 to 255 and 259. Entrance fee \$2/- per exhibit (\$1/- per exhibit for members of the Association.)

Remaining Classes ;—No entrance fee.

THE

Malayan Agricultural Journal.

Vol. XIV.]

JUNE, 1926.

[No. 6.

ANNUAL REPORT OF THE CHEMICAL DIVISION FOR 1925.

B. J. EATON.

STAFF.

The staff of the Division consisted of the following officers:—

<i>Agricultural Chemist</i>	...	B. J. Eaton.
<i>Asst. Agrl. Chemists</i>	...	R. O. Bishop, C. D. V. Georgi, V. R. Greenstreet, and J. H. Dennett.
<i>Asst. Analyst</i>	...	Gunn Lay Teik.

The Agricultural Chemist returned from leave and resumed duty on January 2nd.

The following officers were on leave during the year:—

Major C. D. V. Georgi	...	Jan. 17th till Oct. 23rd.
Mr. V. R. Greenstreet	...	May 29th till Dec. 31st.
Mr. J. H. Dennett	...	Nov. 6th till Dec. 31st.

Mr. R. O. Bishop was appointed to act as Plant Physiologist as from November 20th.

ORGANISATION.

Owing to the shortage of staff, due to officers on leave, several investigations had to be curtailed or postponed.

The work of the Division has been distributed as follows:

Administration and reports by the Agricultural Chemist; rubber investigations by the Agricultural Chemist and Mr. R. O. Bishop; soil investigations by Mr. V. R. Greenstreet and later by Major C. D. V. Georgi assisted by Inche Abdul Majid and Inche Ahmat bin Indot; investigations on nipah palm in connection with the production of power alcohol and on tapioca in connection with the exhaustion of the soil by this crop by Mr. J. H. Dennett; investigations on oil and fats, jelutong, and various miscellaneous investigations by Mr. Gunn Lay Teik.